

Version: 3.0

**TECHNICAL SPECIFICATION****MODEL NO: ED060SCP**

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Customer's Confirmation

Customer \_\_\_\_\_

Date \_\_\_\_\_

By \_\_\_\_\_

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## Revision History

Rev.	Issued Date	Revised Contents
1.0	Mar , 6, 2014	New
2.0	May , 21 , 2014	Page 24. 12. Bar Code definition 1 -EPD Model Code ---> Remove Hydis TFT Page 29 16. Configuration table Remove Hydis TFT Modify Material approved for MP table FPC Error : Mektec ---> Uniflex EPD Driver : Remove Novatek IC Page 30 ADD 18. Optical Characteristics of WF tuning & verification modules
3.0	July , 16 , 2014	Page 19 9-1) Specifications Add color spec as listed Page 29 16. Configuration table Add Mektec into material approval list as FPC vendor

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## 1. Application

The display is a TFT active matrix electrophoretic display, with associated interface and control logic, and a reference system design.

The 6" active area contains 600 x 800 pixels, the display is capable to display images at 2-16 gray levels (1-4 bits) depending on the display controller and the associated waveform file used.

## 2. Features

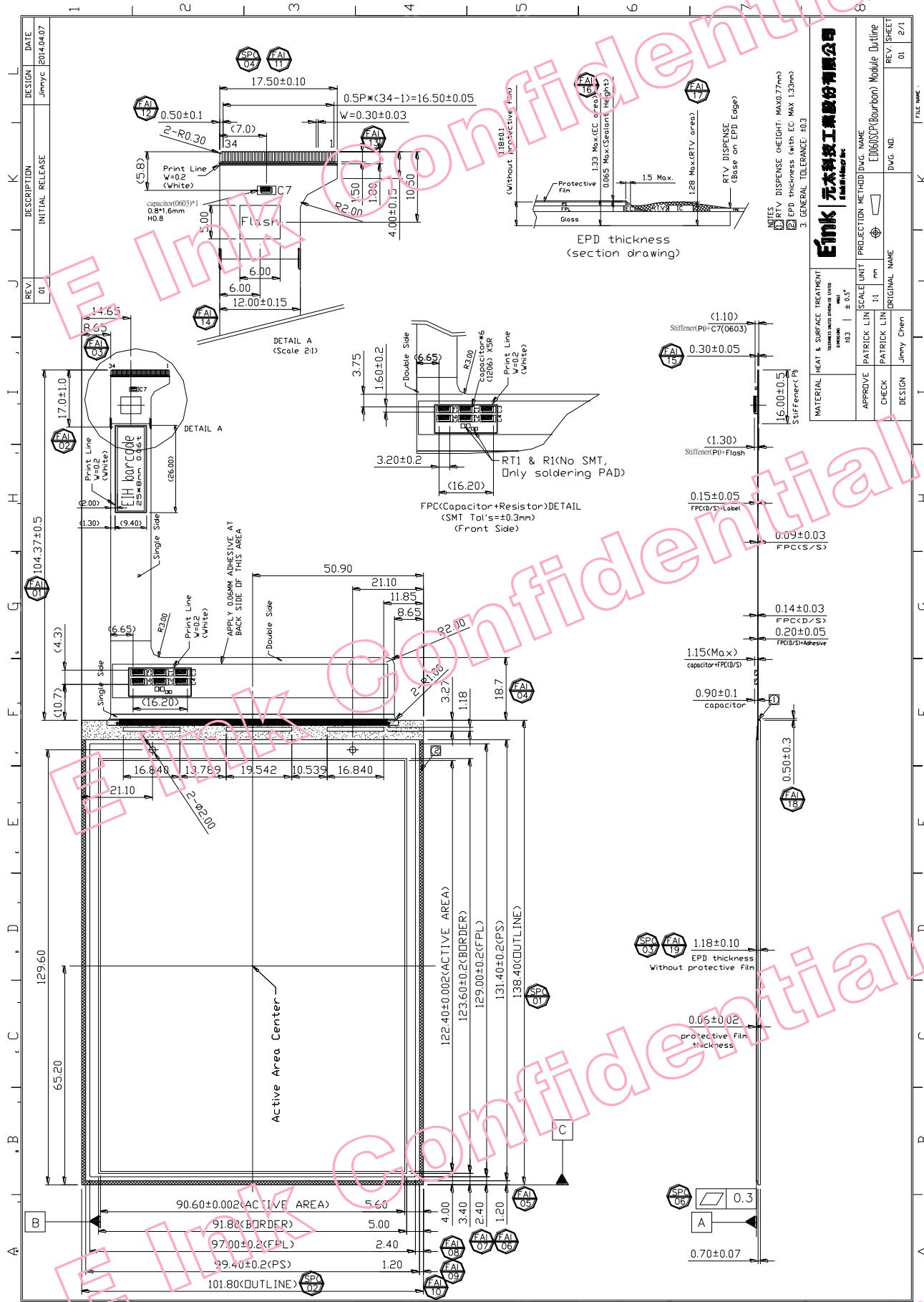
- High contrast TFT electrophoretic
- 600 x 800 display
- High reflectance
- Ultra wide viewing angle
- Ultra low power consumption
- Pure reflective mode
- Bi-stable
- Commercial temperature range
- Landscape, portrait mode
- Antiglare hard-coated front-surface

## 3. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	6.0 (3:4 diagonal)	Inch	
Display Resolution	600 (H)×800(V)	Pixel	
Active Area	90.6 (H)×122.4 (V)	mm	
Pixel Pitch	0.151 (H)×0.153 (V)	mm	
Pixel Configuration	Rectangle		
Outline Dimension	101.8(W)×138.4(H)×1.18(D) (panel area height)	mm	
Module Weight	34 ±3.4	g	
Number of Gray	16 Gray Level (monochrome)		
Display operating mode	Reflective mode		
Surface treatment	Anti-glare treatment for protective sheet		

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## **4. Mechanical Drawing of EPD Module**

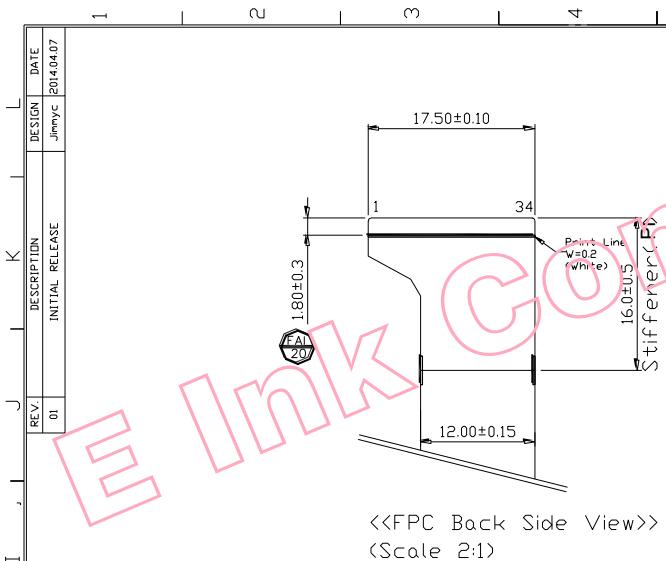


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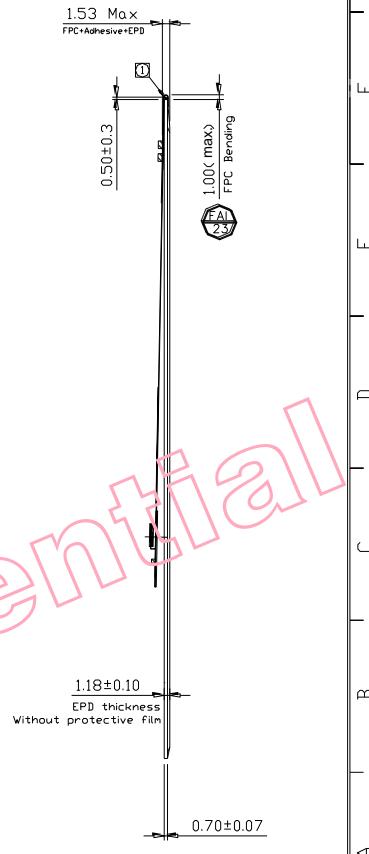
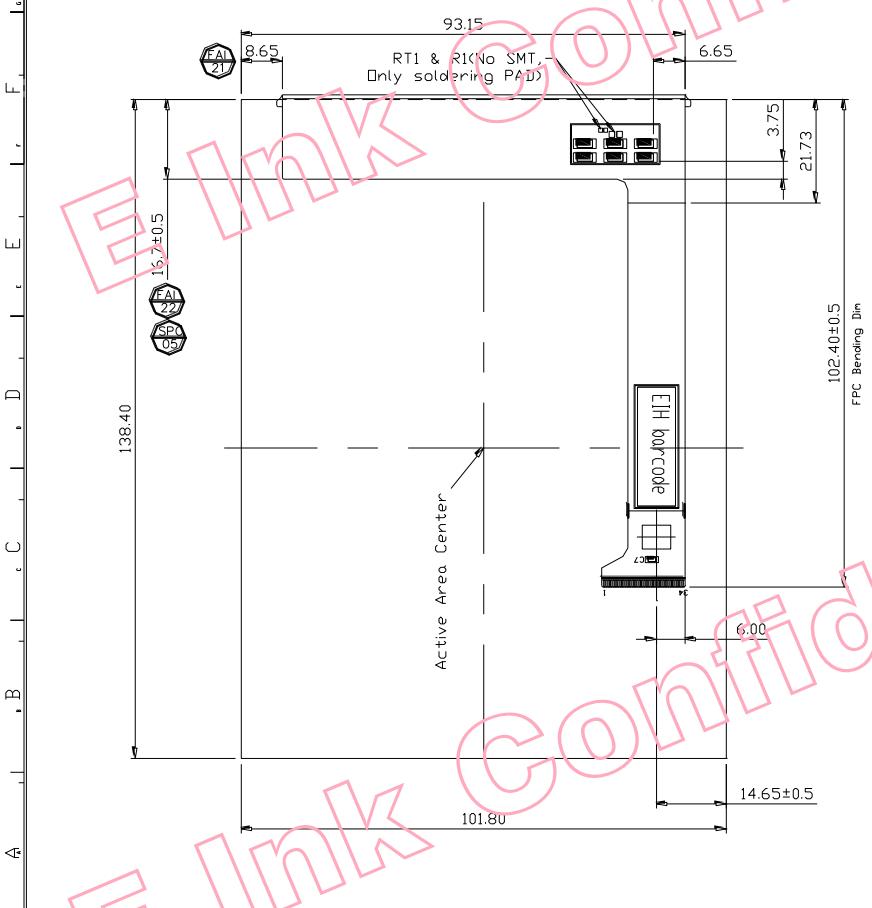
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RTV DISPENSE HEIGHT: MAX10 (mm)				
EPD Spacers (with EC: MAX 1.33mm)				
GENERAL TOLERANCE: ±0.3				
<b>Elink</b>   元大科技工業股份有限公司 				
MATERIAL	HEAT & SURFACE TREATMENT SUBSTRATE MUST BE DRY & CLEAN DIMENSION: $\pm 0.5^\circ$	SCALE UNIT LINEAR: mm	PRODUCTION METHOD: (Bourbon) Module Outline	REV. SHEET NO.
APPROVE	PATRICK LIN		EDG002(Bourbon) Module Outline	01
CHECK	PATRICK LIN			
DESIGN	Jimmy Chen		ORIGINAL NAME	2/2



# ⟨⟨EPD Back Side View⟩⟩



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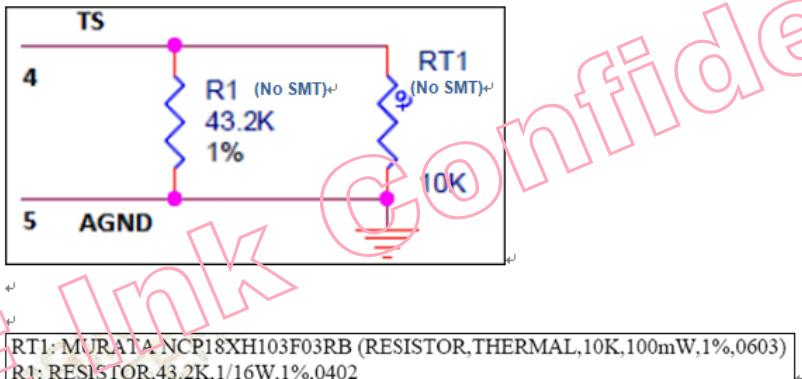
## 5. Input/Output Interface

### 5-1) Connector type: FH34S-34S-0.5SH(50)-Hirose

#### Pin Assignment

Pin #	Signal	Description	Remark
1	VNEG	Negative power supply source driver	
2	VEE	Negative power supply gate driver	
3	VSS	Ground	
4	TS	Thermistor Sense Pin	Note 5-1
5	AGND	Thermistor Analog Ground	Note 5-1
6	VDD	Digital power supply drivers (3.3V)	
7	VSS	Ground	
8	XCL	Clock source driver	
9	VSS	Ground	
10	XLE	Latch enable source driver	
11	XOE	Output enable source driver	
12	XSTL	Start pulse source driver	
13	D0	Data signal source driver	
14	D1	Data signal source driver	
15	D2	Data signal source driver	
16	D3	Data signal source driver	
17	D4	Data signal source driver	
18	D5	Data signal source driver	
19	D6	Data signal source driver	
20	D7	Data signal source driver	
21	VCOM	Common connection	
22	SPI_SCL	Serial Data Clock for Flash memory	
23	SPI_SDI	Serial Data Input for Flash memory	
24	SPI_NCS	Chop Select for Flash memory	
25	SPI_SDO	Serial Data Output for Flash memory	
26	VSS	Ground	
27	MODE 1	Output mode selection gate driver	
28	CKV	Clock gate driver	
29	SPV	Start pulse gate driver	
30	VDD2	SPI power supply (1.8V)	
31	BORDER	Border connection	
32	VSS	Ground	
33	VPOS	Positive power supply source driver	
34	VGG	Positive power supply gate driver	

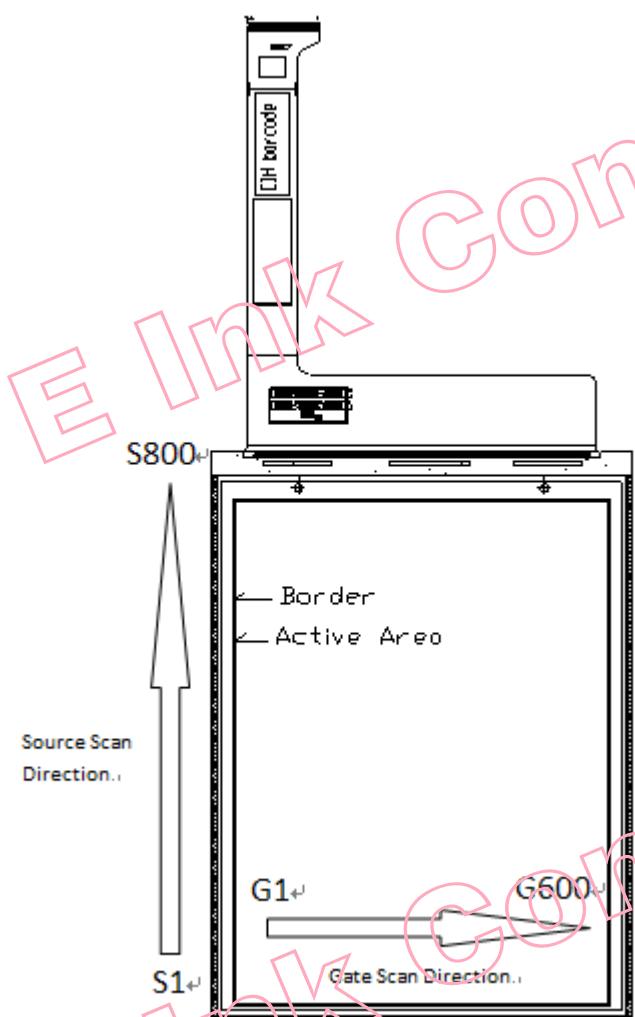
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**Note 5-1****5-2) Flash Format**

(1) 0x00000 ~ 0x00885 :EPSON instruction code
(2) 0x00886 ~ 0x6FFFF : E Ink waveform
(3) 0x70000 ~ 0x7000F : Product part number (ex:ED060SC5)
(4) 0x70010 ~ 0x7001F : Vcom voltage (EX: -1.54)
(5) 0x70020 ~ 0x7003F : Waveform version (ex:V110_B059_60_TE3005)
(6) 0x70040 ~ 0x7004F : FPL version (ex:B059)
(7) 0x70050 ~ 0x7007F : Barcode (ex:E1U0045910000000EME609B016001001)
(8) 0x70080 ~ 0x7008F : Resolution :Source_pixels x Gate_pixels (ex:800*600)
(9) 0x70090 ~ 0x700AF : Dimension of Active Area:Length x Width at unit of mm (ex:122.4mm*90.6mm)
(10) 0x700B0 ~ 0x700BF : VDD voltage (ex:3.3)
(11) 0x700C0 ~ 0x702FF : Reserved
(12) 0x70300 ~ 0x7030F : Version (ex:Ver_1.0)

Note : VCOM has been measured appropriately at manufacturer site and programmed into flash chip on FPC at this product.

## 5-3) Panel Scan direction



## 6. Electrical Characteristics

## 6-1) Absolute maximum rating

Parameter	Symbol	Rating	Unit	Remark
Logic Supply Voltage	VDD	-0.3 to +7	V	--
Digital voltage supply 2 range	VDD2	-0.6 to +4	V	Note 1
Positive Supply Voltage	V <sub>POS</sub>	-0.3 to +18	V	--
Negative Supply Voltage	V <sub>NEG</sub>	+0.3 to -18	V	--
Max .Drive Voltage Range	V <sub>POS</sub> - V <sub>NEG</sub>	36	V	--
Supply Voltage	V <sub>G</sub>	-0.3 to +45	V	--
Supply Voltage	V <sub>EE</sub>	-25.0 to +0.3	V	--
Supply Range	V <sub>G</sub> -V <sub>EE</sub>	-0.3 to +45	V	--
Operating Temp. Range	T <sub>OTR</sub>	0 to +50	°C	--
Storage Temperature	T <sub>STG</sub>	-25 to +70	°C	--

Note 1: SPI Flash IC Power Supply

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**6-2) Panel DC characteristics**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Signal ground	V <sub>SS</sub>		-	0	-	V
Logic Voltage supply	V <sub>DD</sub>		3.0	3.3	3.6	V
	I <sub>VDD</sub>	V <sub>DD</sub> =3.3V	-	1.05	3.15	mA
Logic Voltage supply2 (Active)	V <sub>DD2</sub>		1.65	1.8	1.95	V
	I <sub>VDD2</sub>	V <sub>DD2</sub> =1.8V		6	9	mA
Logic Voltage supply2 (Standby)	V <sub>DD2</sub>		1.65	1.8	1.95	V
	I <sub>VDD2</sub>	V <sub>DD2</sub> =1.8V		25	50	μA
Gate Negative supply	V <sub>EE</sub>		-21	-20	-19	V
	I <sub>EE</sub>	V <sub>EE</sub> =-20V	-	0.8	2.4	mA
Gate Positive supply	V <sub>GG</sub>		21	22	23	V
	I <sub>GG</sub>	V <sub>GG</sub> =22V	-	0.8	2.4	mA
Source Negative supply	V <sub>NEG</sub>		-15.4	-15	-14.6	V
	I <sub>NEG</sub>	V <sub>NEG</sub> =-15V	-	18	36	mA
Source Positive supply	V <sub>POS</sub>		14.6	15	15.4	V
	I <sub>POS</sub>	V <sub>POS</sub> =15V	-	16	32	mA
Border supply	V <sub>COM</sub>		-2.5	Adjusted	-0.3	V
Asymmetry source	V <sub>Asym</sub>	V <sub>POS</sub> +V <sub>NEG</sub>	-800	0	800	mV
Common voltage	V <sub>COM</sub>		-2.5	Adjusted	-0.3	V
	I <sub>COM</sub>		-	0.25	-	mA
Panel Power	P		-	547	1131	mW
Standby power panel	P <sub>STBY</sub>		-	-	0.4	mW
Operating temperature			0	-	50	°C
Storage temperature			-25	-	70	°C

- The maximum power consumption is measured using 85Hz waveform with following pattern transition: from pattern of repeated 1 consecutive black scan lines followed by 1 consecutive white scan line to that of repeated 1 consecutive white scan lines followed by 1 consecutive black scan lines. (Note 6-1)
- The Typical power consumption is measured using 85Hz waveform with following pattern transition: from horizontal 4 gray scale pattern to vertical 4 gray scale pattern. (Note 6-2)
- The standby power is the consumed power when the panel controller is in standby mode.
- The listed electrical/optical characteristics are only guaranteed under the controller & waveform provided by E Ink.
- Vcom is recommended to be set in the range of assigned value ± 0.1V.
- The maximum I<sub>COM</sub> inrush current is about 800 mA

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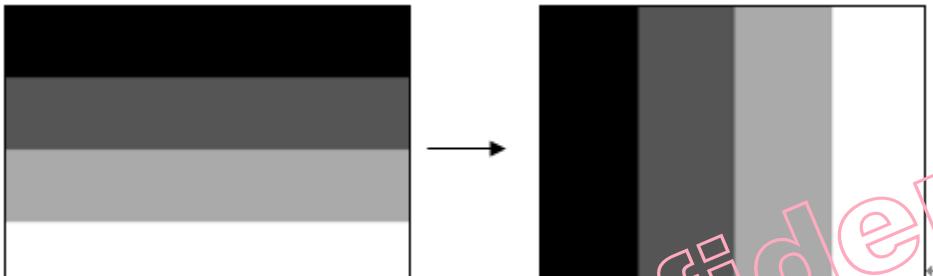
Note 6-1

The maximum power consumption



Note 6-2

The Typical power consumption

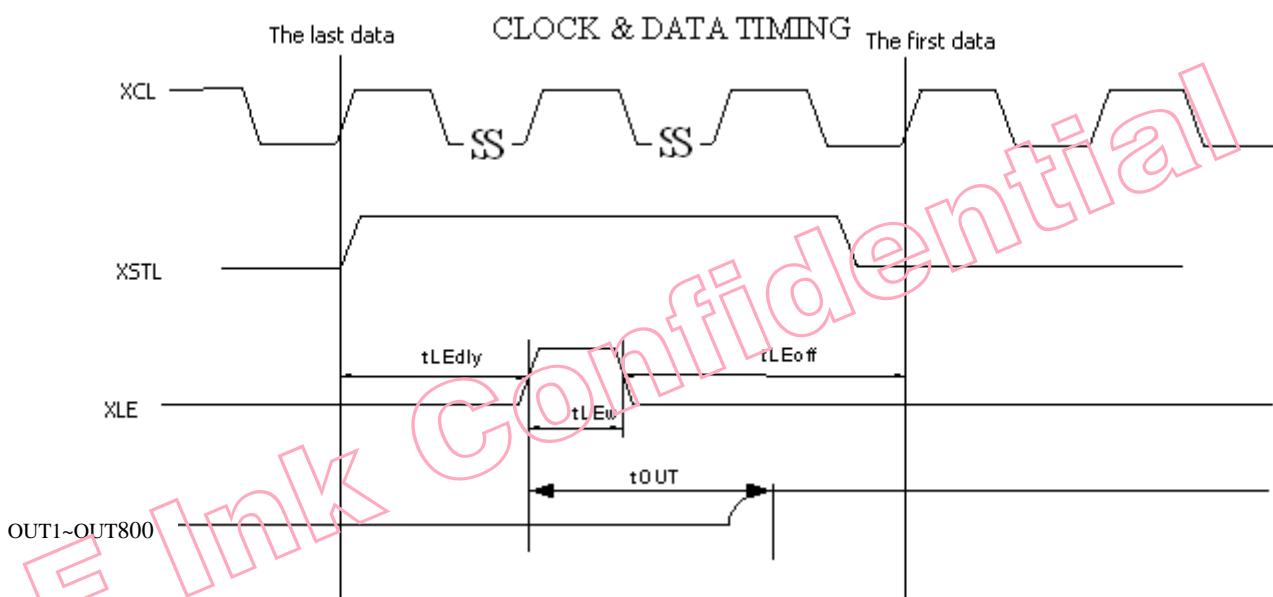


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**6-3 ) Source IC & Gate IC Timing Chart**

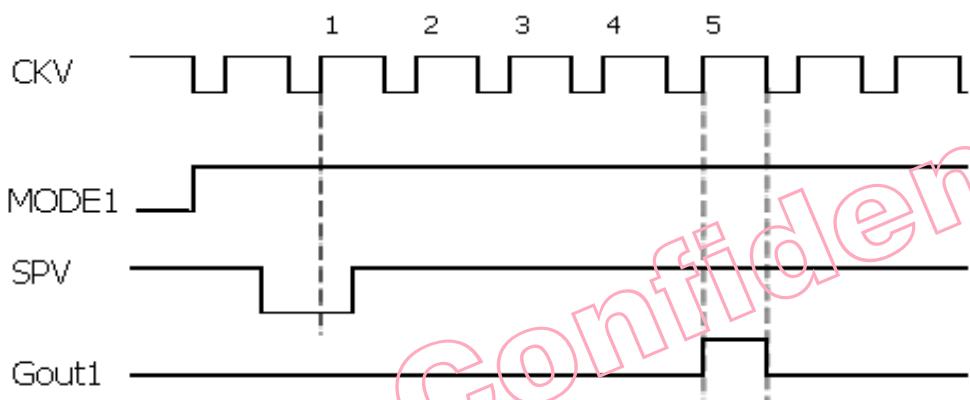
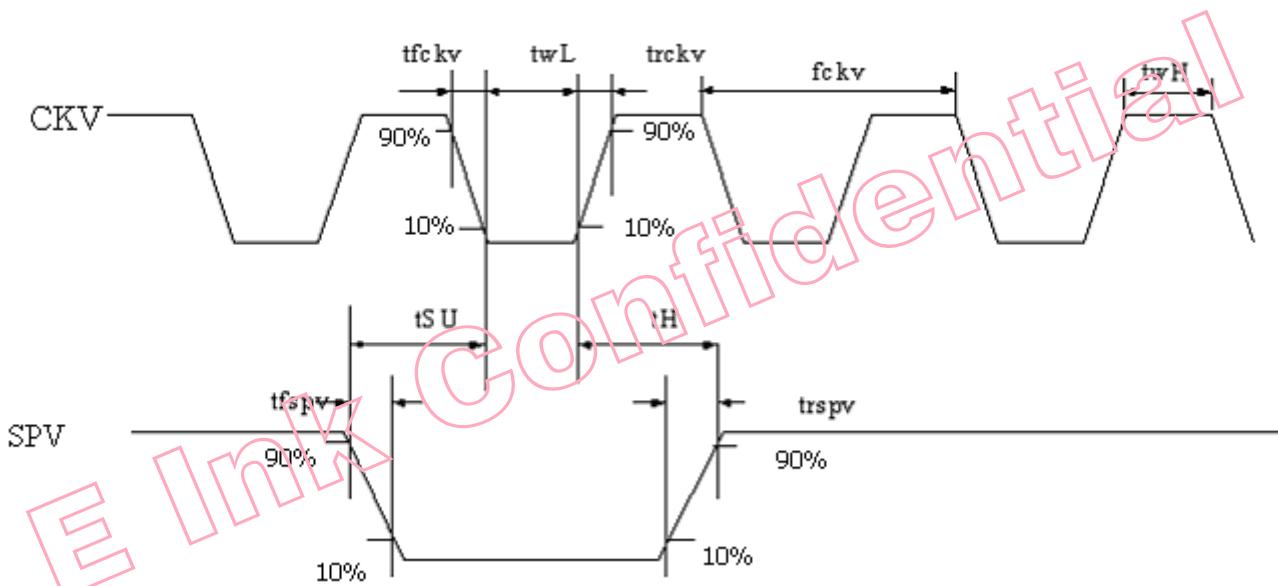
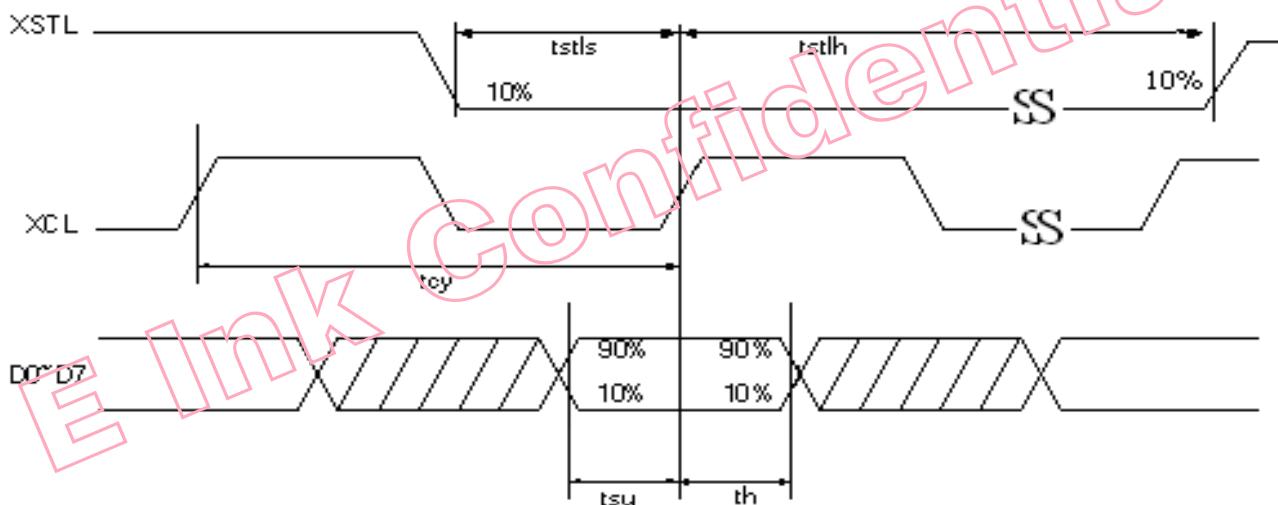
VDD=3.0V to 3.6V, unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	fckv	-	-	200	kHz
Minimum "L" clock pulse width	twL	0.5	-	-	us
Minimum "H" clock pulse width	twH	0.5	-	-	us
Clock rise time	trckv	-	-	100	ns
Clock fall time	tfckv	-	-	100	ns
SPV setup time	tSU	100	-	twH-100	ns
SPV hold time	tH	100	-	twH-100	ns
Pulse rise time	trspv	-	-	100	ns
Pulse fall time	tfspv	-	-	100	ns
Clock XCL cycle time	tcy	25	-	-	ns
D0 .. D7 setup time	tsu	12	-	-	ns
D0 .. D7 hold time	th	12	-	-	ns
XSTL setup time	tstls	12	-	-	ns
XSTL hold time	tstlh	12	-	-	ns
XLE on delay time	tLEdly	40	-	-	ns
XLE high-level pulse width (When VCC=3.0V to 3.6V)	tLEW	150	-	-	ns
XLE off delay time	tLEoff	200	-	-	ns
Output setting time to +/- 30mV( $C_{load}=200\text{pF}$ )	tout	-	-	12	us



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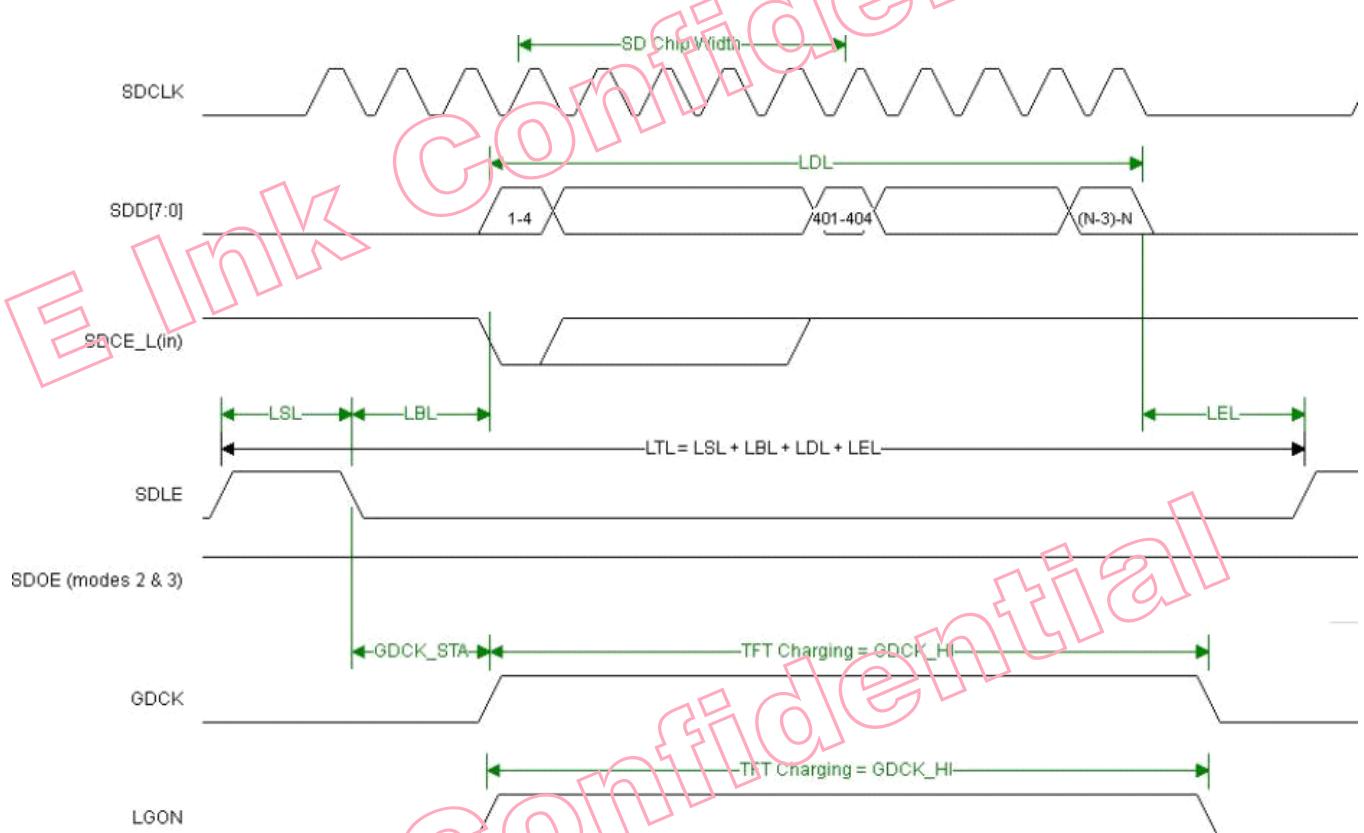
## OUTPUT LATCH CONTROL SIGNALS



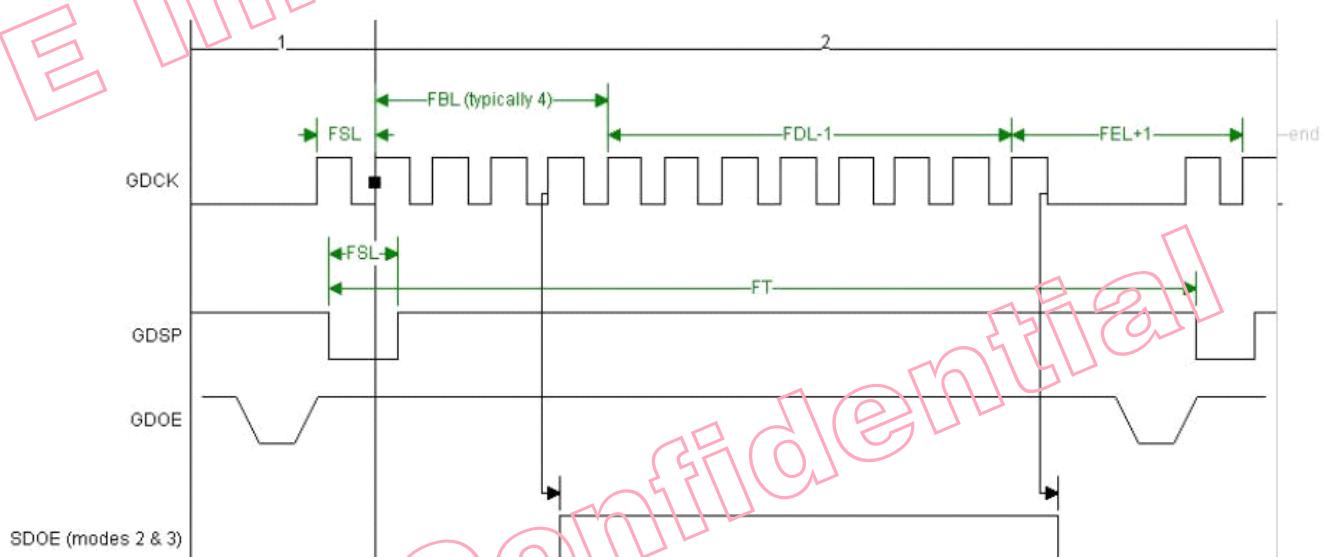
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#### 6-4 ) Controller Timing for BD-5BIT Waveform

This timing mode is depicted on Figure 1 and Figure 2 and it refers to timing of Source Driver Output Enable (SDOE) and Gate Driver Clock (GDCK). Note, that in this mode LCON follows GDCK timing.



**Figure 1 Line Timing in Mode 3**



**Figure 2 Frame Timing in Mode 3**

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## Table Timing Parameters for 800\*600 at 85Hz Frame Rate

Mode	3	Resolution 800*600				
SDCK 【MHz】	13					
Pixels Per SDCK	4					
Line Parameters 【SDCK】	LSL	LBL	LDL	LEL	GDCK_STA	LGONL
	2	4	200	43.5	1	204.5
Frame Parameters 【lines】	FSL	FBL	FDL	FEL	-	FR 【Hz】
	1	4	600	8	-	85
Verified Part Numbers	See Table 4					

Note 1 : For parameters definition , see Section 6. Active Matrix Electronic Paper Display Timings

Note 2 : For Isis Controller GDCK\_STA and LGONL are not settable parameters ; GDCK\_STA=LBL,  
LGONL=LDL+0.5

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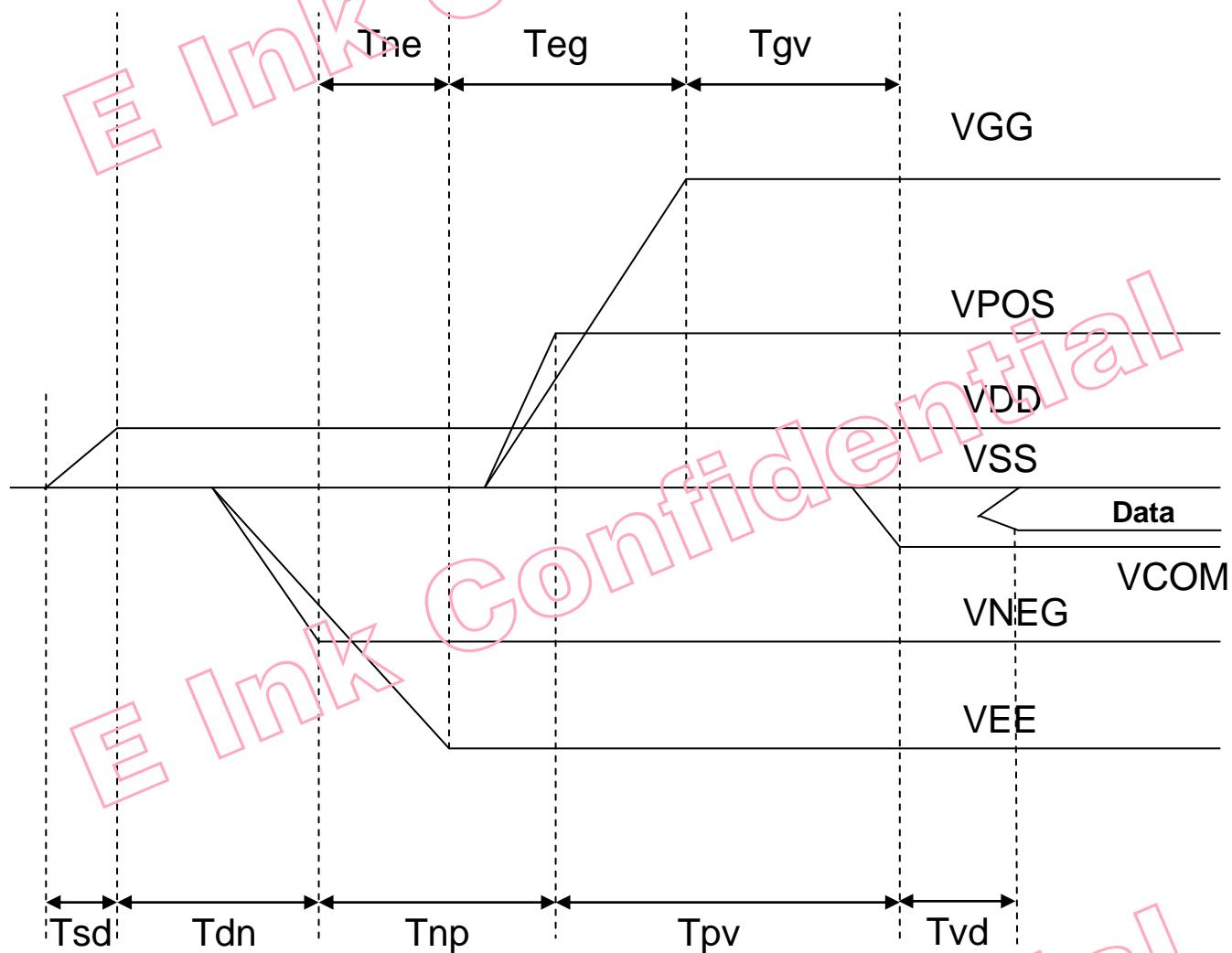
## 7. Power on Sequence

Power Rails must be sequenced in the following order :

1. VSS → VDD → VNEG → VPOS (Source driver) → VCOM

2. VSS → VDD → VEE → VGG (Gate driver)

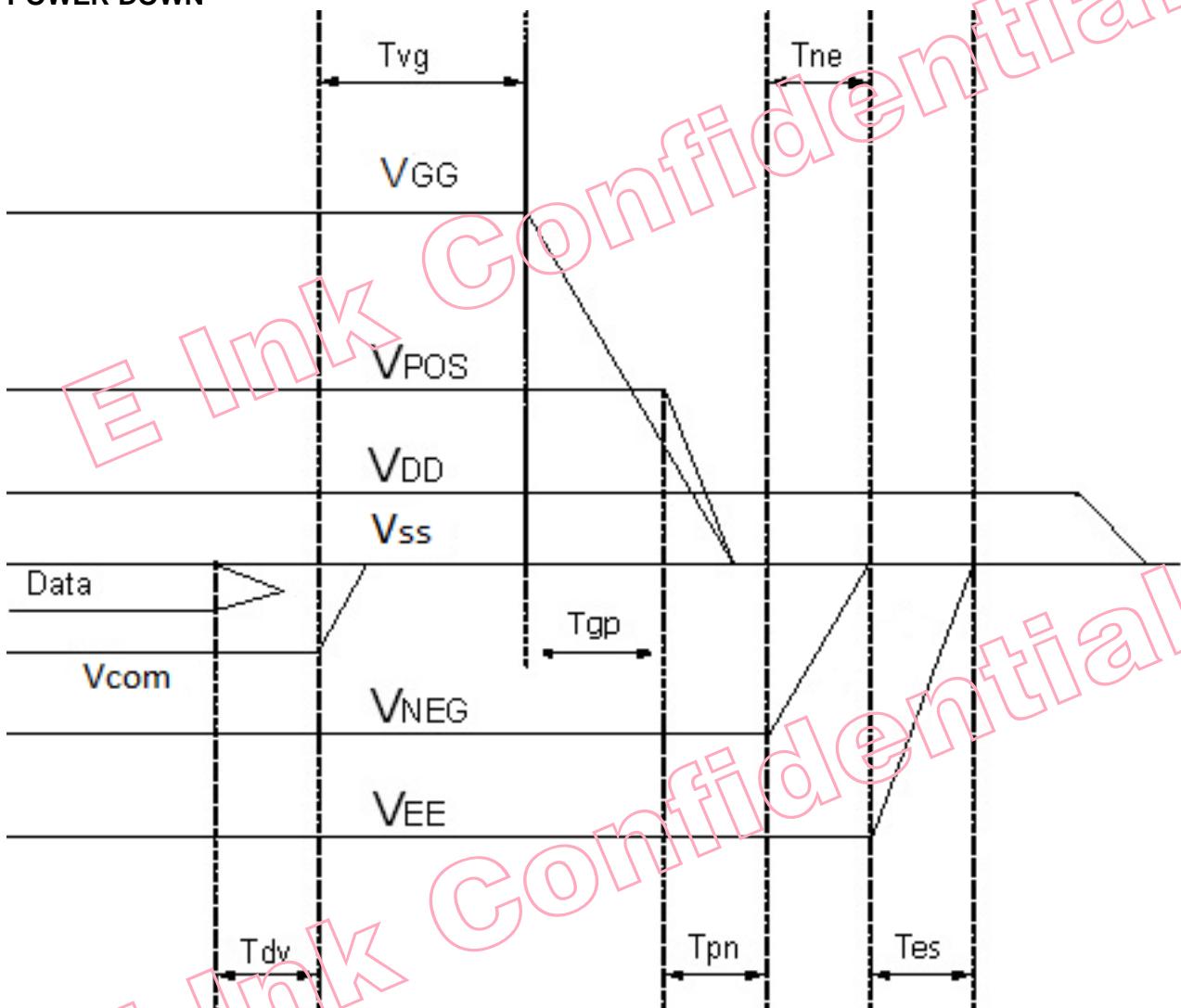
### POWER ON



	Min	Max
Tsd	30us	-
Tdn	100us	-
Tne	1000us	-
Teg	1000us	-
Tgv	100us	-

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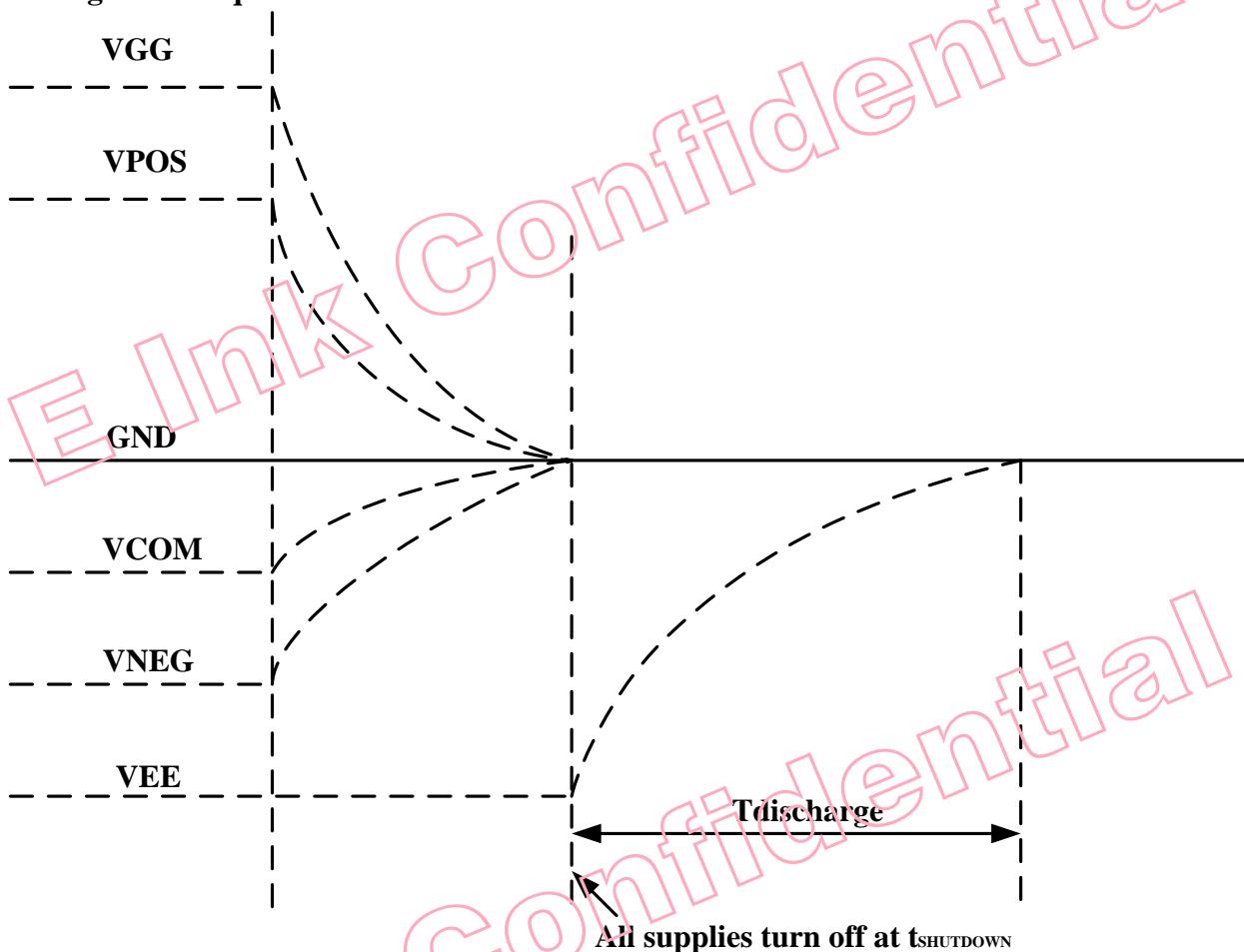
## POWER DOWN



	Min	Max
Tdv	100μs	-
Tvg	0μs	-
Tgp	0μs	-
Tpn	0μs	-
Tne	0μs	-
Tes	0.5s	-

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## 8. Discharge time Sequence



Note8-1 : Supply voltages decay through pull-down resistors

Note8-2 : Begin to turn off VGL power after VNEG and VPOS are completely or almost discharged to GND state.

Note8-3 : VEE must remain negative of Vcom during decay period

### 8-1) Refresh Rate

The module ED060SCP is applied at a maximum screen refresh rate of 85Hz.

	Min	Max
Refresh Rate	-	85Hz

## 9. Optical characteristics

### 9-1) Specifications

Measurements are made with that the illumination is under an angle of 45 degrees, the detector is perpendicular unless otherwise specified.

T = 25°C

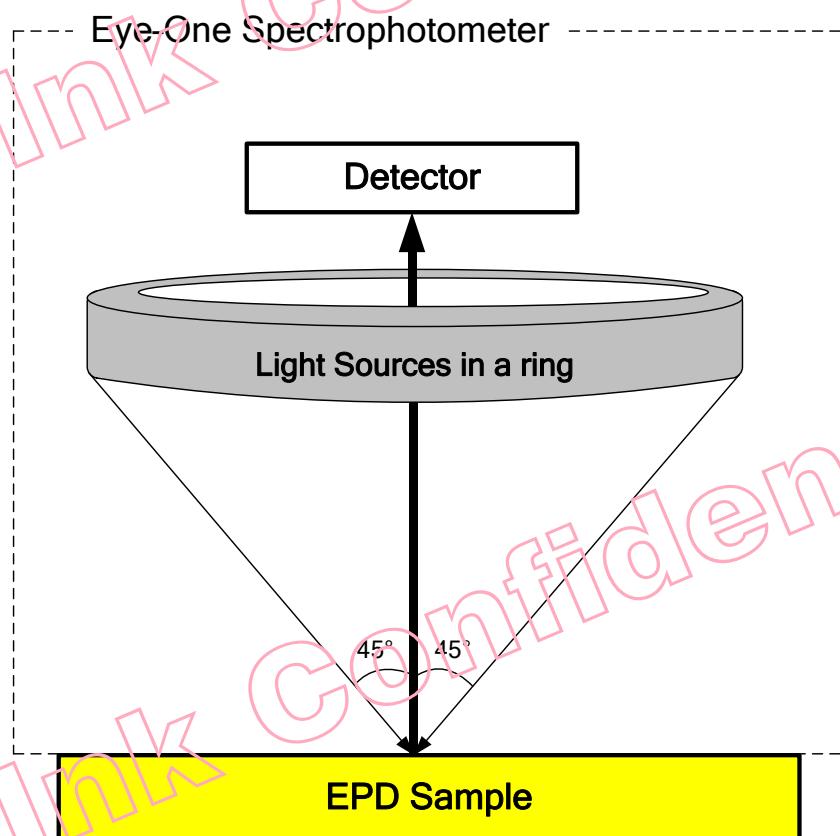
Symbol	Parameter	Conditions	Min	Typ.	Max	Unit	Note
R	Reflectance	White	30	40	-	%	Note 9-1
Gn	N <sub>th</sub> Grey Level	-	-	DS+(WS-DS) xn/(m-1)	-	L*	-
CR	Contrast Ratio	-	10	12	-	-	-
a*	Average Color		-3.2	-	-1.8		a*
b*	Average Color		-1.2	-	2.0		b*

WS: White state , DS: Dark state, Gray state from Dark to White :DS、G1、G2...、Gn...、Gm-2、WS  
 m:4、8、16 when 2、3、4 bits mode

Note 9-1: Luminance meter: Eye – One Pro Spectrophotometer

### 9-2) Definition of contrast ratio

The contrast ratio (CR) is the ratio between the reflectance in a full white area (RI) and the reflectance in a dark area (Rd): CR = RI / Rd



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### 9-3) Reflection Ratio

The reflection ratio is expressed as:

$$R = \text{Reflectance Factor}_{\text{white board}} \times \left( L_{\text{center}} / L_{\text{white board}} \right)$$

$L_{\text{center}}$  is the luminance measured at center in a white area ( $R=G=B=1$ ).  $L_{\text{white board}}$  is the luminance of a standard white board. Both are measured with equivalent illumination source. The viewing angle shall be no more than 2 degrees.

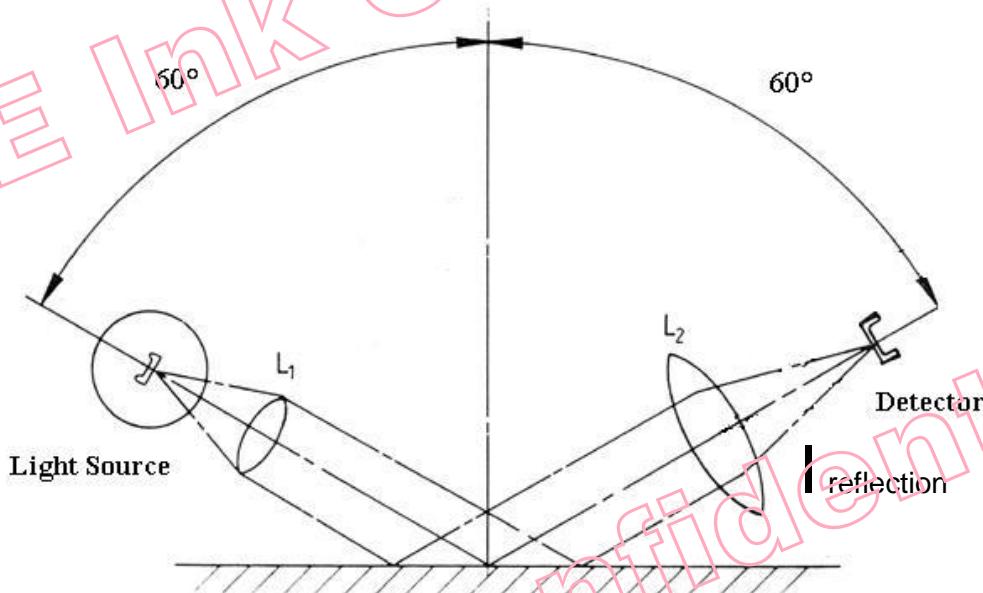
### 9-4) Gloss

Performance	Measurement unit (%)
60° gloss	55±10

Measurements are made by micro-TRI-gloss (D-4430)

### 9-5) Definition of Gloss

$$\text{Gloss} = \frac{\text{Reflection (Sample)}}{\text{Reflection (Standard)}} \times 100 \%$$



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## 10. HANDLING, SAFETY AND ENVIRONMENTAL REQUIREMENTS AND REMARK

### WARNING

The display glass may break when it is dropped or bumped on a hard surface. Handle with care. Should the display break, do not touch the electrophoretic material. In case of contact with electrophoretic material, wash with water and soap.

### CAUTION

The display module should not be exposed to harmful gases, such as acid and alkali gases, which corrode electronic components.

Disassembling the display module can cause permanent damage and invalidate the warranty agreements.

IPA solvent can only be applied on active area and the back of a glass. For the rest part, it is not allowed.

### Mounting Precautions

- (1) It's recommended that you consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module.
- (2) It's recommended that you attach a transparent protective plate to the surface in order to protect the EPD. Transparent protective plate should have sufficient strength in order to resist external force.
- (3) You should adopt radiation structure to satisfy the temperature specification.
- (4) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the PS at high temperature and the latter causes circuit break by electro-chemical reaction.
- (5) Do not touch, push or rub the exposed PS with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of PS for bare hand or greasy cloth. (Some cosmetics deteriorate the PS)
- (6) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach the PS. Do not use acetone, toluene and alcohol because they cause chemical damage to the PS.
- (7) Wipe off saliva or water drops as soon as possible. Their long time contact with PS causes deformations and color fading.

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**Data sheet status**

Product specification	This data sheet contains formal product specifications.
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**Limiting values**

Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Application information**

Where application information is given, it is advisory and does not form part of the specification.

**REMARK**

All The specifications listed in this document are guaranteed for module only. Post-assembled operation or component(s) may impact module performance or cause unexpected effect or damage and therefore listed specifications is not warranted after any Post-assembled operation.

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**11. Reliability test**

TEST	CONDITION	METHOD	REMARK
1 High-Temperature Operation	T = +50°C, RH = 30% for 240 hrs	IEC 60 068-2-2Bp	At the end of the test, electric, mechanical, and optical specifications shall be satisfied.
2 Low-Temperature Operation	T = 0°C for 240 hrs	IEC 60 068-2-2Ab	At the end of the test, electric, mechanical, and optical specifications shall be satisfied.
3 High-Temperature Storage	T = +70°C, RH=23% for 240 hrs Test in white pattern	IEC 60 068-2-2Bp	At the end of the test, electric, mechanical, and optical specifications shall be satisfied.
4 Low-Temperature Storage	T = -25°C for 240 hrs Test in white pattern	IEC 60 068-2-1Ab	At the end of the test, electric, mechanical, and optical specifications shall be satisfied.
5 High-Temperature, High-Humidity Operation	T = +40°C, RH = 90% for 168 hrs	IEC 60 068-2-3CA	At the end of the test, electric, mechanical, specifications shall be satisfied.
6 High Temperature, High- Humidity Storage	T = +60°C, RH=80% for 240hrs Test in white pattern	IEC 60 068-2-3CA	At the end of the test, electric, mechanical, specifications shall be satisfied.
7 Temperature Cycle	-25°C → +70°C, 100 Cycles 30min 30min Test in white pattern	IEC 60 068-2-14	At the end of the test, electric, mechanical, specifications shall be satisfied.
8 Solar radiation test	765 W/m <sup>2</sup> for 168hrs,40°C Test in white pattern	IEC60 068-2-5Sa	Optical characteristics shall be satisfied.
9 Package Vibration	1.04G, Frequency: 10~500Hz Direction: X,Y,Z Duration: 1 hours in each direction	Full packed for shipment	At the end of the test, electric, mechanical, and optical specifications shall be satisfied.
10 Package Drop Impact	Drop from height of 122 cm on concrete surface. Drop sequence: 1 corner, 3 edges, 6 faces One drop for each.	Full packed for shipment	At the end of the test, electric, mechanical, and optical specifications shall be satisfied.
11 Electrostatic Effect (non-operating)	(Machine model)+/- 250V 0Ω, 200pF	IEC 62179, IEC 62180	At the end of the test, electric, mechanical, specifications shall be satisfied.
12 Altitude test Operation	700hPa (= 3000m ),48Hr		At the end of the test, electric, mechanical, specifications shall be satisfied.
13 Altitude test Storage	260hPa (= 10000m ),48Hr Test in white pattern		At the end of the test, electric, mechanical, specifications shall be satisfied.
14 Stylus Tapping	POLYACETAL Pen: Top R:0.8mm Load: 300gf Speed: 2 times/sec Total 13,500times,		Pass criteria – no glass breakage or damage to microcapsules. Note : test with housing and device

Actual EMC level to be measured on customer application

Note : The protective film must be removed before temperature test.

## [Criteria]

In the standard conditions, there is not display function NG issue occurred.

(Including : line defect, no image) All the cosmetic specification is judged before the reliability stress.

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**12. Bar Code definition**

E01	00	4	01	1	I	7	4	00361	A	T
1	2	3	4	2	5	6	2	7	2	8

-EPD Model Code

EPD Model Code	TFT manufacturer	Part Number
EBS	Innolux	ED060SCPC1
EPT	CPT	ED060SCPT1
EER	E Ink	ED060SCPP1

-Internal Control Codes

DO NOT CARE

-FPL Version Code

FPL Version Code	Platform
6	Eink ver. V220
8	Eink ver. V220E

-FPL Batch Code

01~99	001~099	G0~G9	160~169	Q0~Q9	230~239	X0~X9	300~309
A0~A9	100~109	H0~H9	170~179	R0~R9	240~249	Y0~Y9	310~319
B0~B9	110~119	J0~J9	180~189	S0~S9	250~259	Z0~Z9	320~329
C0~C9	120~129	K0~K9	190~199	T0~T9	260~269		
D0~D9	130~139	L0~L9	200~209	U0~U9	270~279		
E0~E9	140~149	M0~M9	210~219	V0~V9	280~289		
F0~F9	150~159	N0~N9	220~229	W0~W9	290~299		

-Year

Year	Translation
N	2013
P	2014
Q	2015
R	2016
S	2017

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.	.
Z	2024

## 6-Month

Month	Translation
1	Jan
2	Feb
3	Mar
4	Apr
5	May
6	Jun
7	Jul
8	Aug
9	Sep
A	Oct
B	Nov
C	Dec

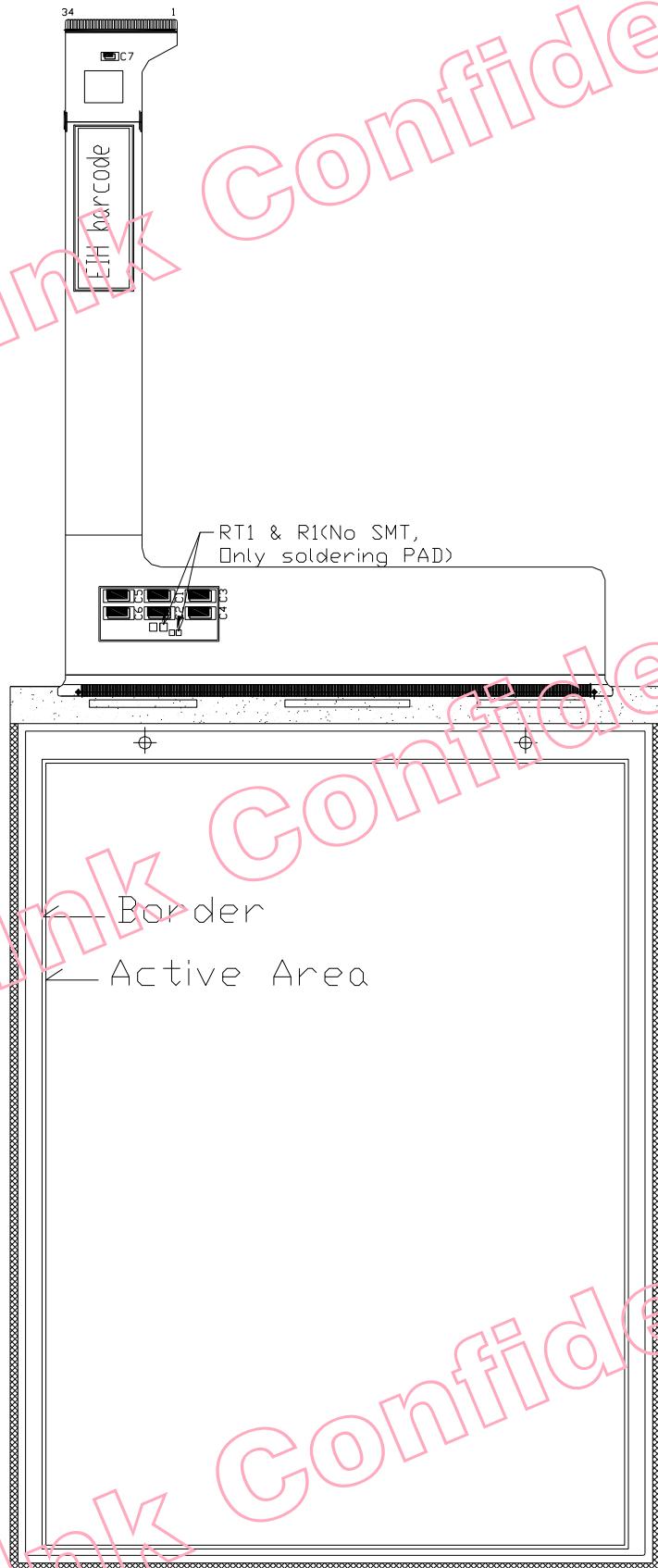
## 7-Serial Number

Serial Number
00000-99999

## 8-Module Manufacturer Code

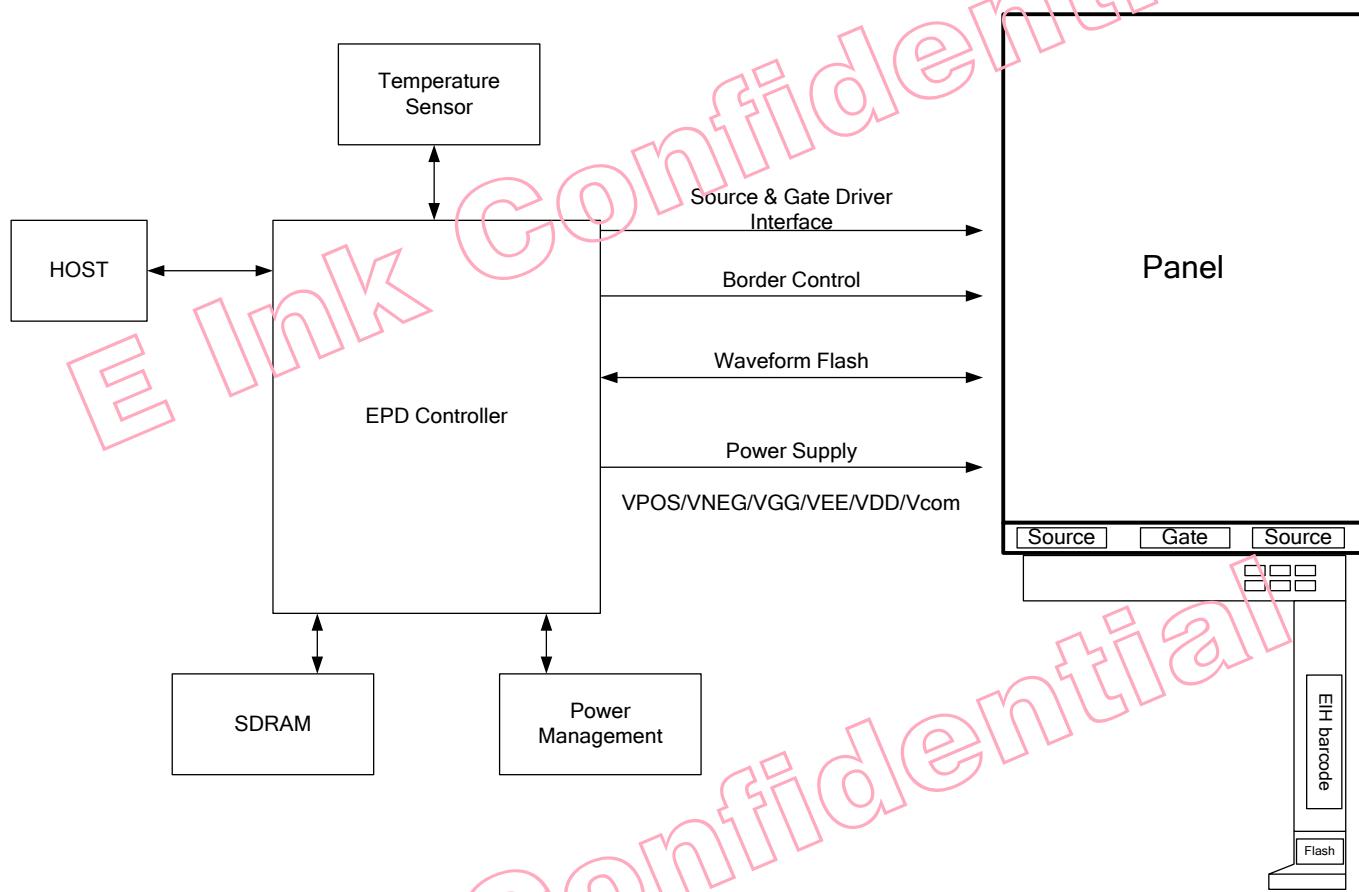
Module Manufacturer Code	Translation
T	TOC Feb3
Y	TOC Feb2
K	TOC Feb1
P	EIH
S	MOS
V	Microview
G	TYT FAB5
L	TYT FAB4

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**13. Border definition**

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## 14. Block Diagram



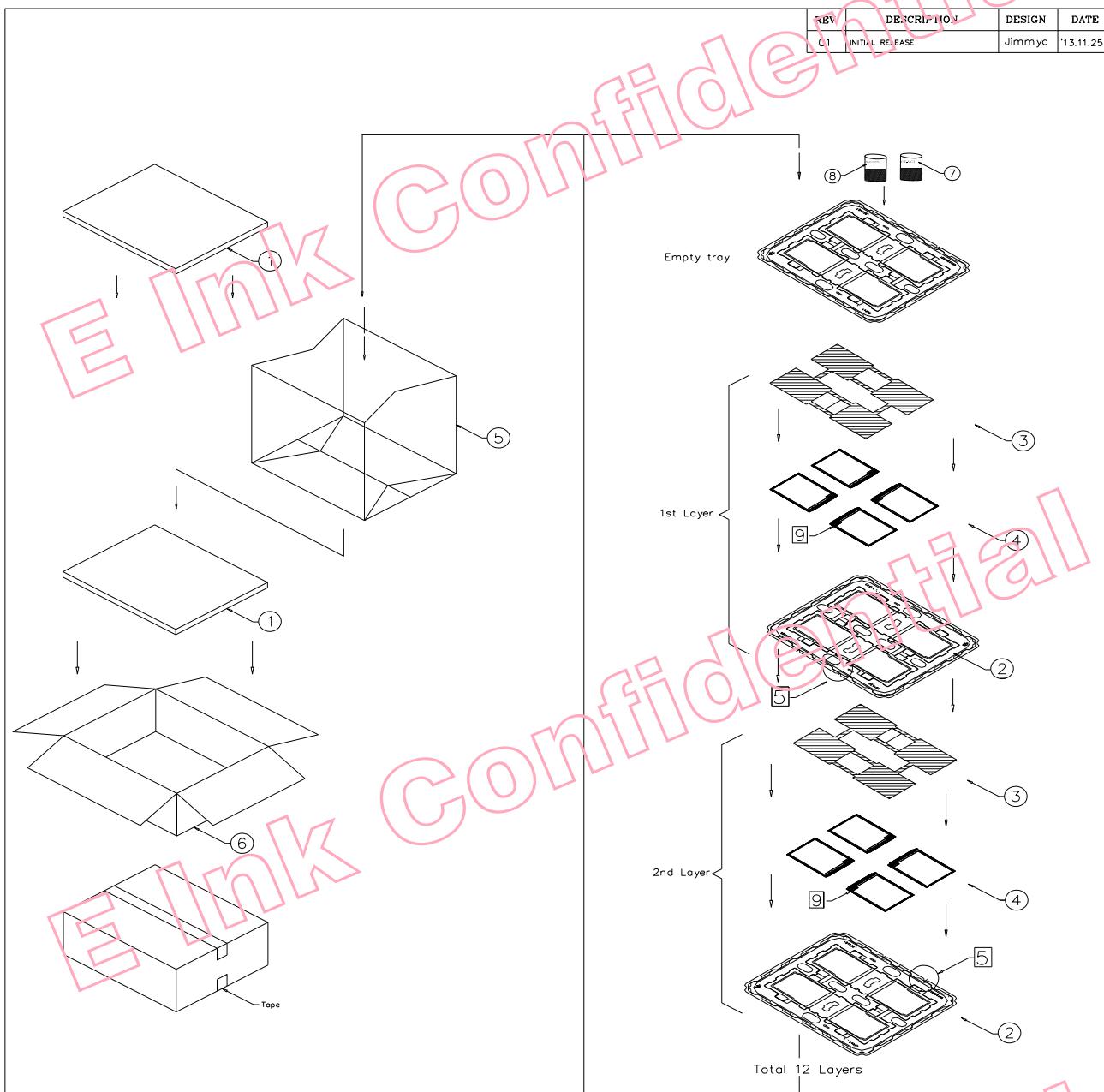
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## 15. Packing

NOTE:

1. One layer include: 1 piece of cushion sheet, 4 pcs module & 1 piece of tray.
2. Q'TY: 48 pcs panel/carton.
3. Dimension: 455\*375\*190mm
4. Weight: 4.6 KG
5. Make sure tray stacked with 180° rotation. We can check this by lateral side view.
6. The thickness of raw material of tray before froming is t=1.0mm.

ITEM	PART NO.	DESCRIPTION	QTY	REMARK
9	EASY TAPE (For Remove Protect Sheet)		48	
8	30g厚膠合紙(保護膜)7*95mm(編號K0030)		21	
7	防靜電袋(保護容積25L)		3	
6	CARTON INTERNAL		1	
5	摺口袋450*380*700mm		1	抗靜電
4	ED060SCP		48	
3	EPE CUSHION SHEET		12	抗靜電
2	PS TRAY		13	抗靜電
	EPE FOAM		2	

MTL.SPEC.		UNSPECIFIED TOL'S ± 5.0mm	REMARK		DWG.TITLE			
		ANGLE	ROUGHNESS		ED060SCP PACKING Draw			
APPROVE	Patrick Lin	12.11.25	SCALE	UNIT	SHEET			
CHECK	Patrick Lin	12.11.25	1:1	mm	1 OF 1			
DESIGN	Jimmy Chen	12.11.25	MTL.NO.			DWG.NO.	REV. 01 A4 SIZE	

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**16. Configuration table**

Product Number	EPD Module	TFT	FPL Version	Module	Remark
				Manufacture	
ED060SCPC1	EBS	Innolux	6	K.T.Y.L.G	available for MP and engineering samples
ED060SCPC1	EBS	Innolux	6	P	available for engineering samples
ED060SCPT1	EBT	CPT	6	K.T.Y.L.G	available for MP and engineering samples
ED060SCPT1	EBT	CPT	6	P	available for engineering samples
ED060SCPP1	EBR	E Ink	6	K.T.Y.L.G	available for MP and engineering samples
ED060SCPP1	EBR	E Ink	6	P	available for engineering samples

Material approved for MP

PS	SG , Oike
EPD Driver	FitiPower , Ultra Chip
FPC	Career , Uniflex , Mektec
SPI flash	MXIC 4M , Winbond 4M

**17. WF update time**

T limits [° C] (inclusive)		Update Times (ms)									
		INIT		DU		DU4		GC16/GL16 GLR16/GLD16		A2	
Low	High	Typical	Typical	Max	Typical	Max	Typical	Max	Typical	Max	Typical
0	3	3000	580	680	610	720	1400	1540	270	300	
3	6	3000	500	580	530	620	1000	1100	240	260	
6	9	2000	450	520	480	580	900	990	220	250	
9	12	2000	450	520	480	580	900	990	220	250	
12	15	2000	350	400	380	450	800	880	180	200	
15	18	2000	300	340	330	380	550	610	150	170	
18	21	2000	260	300	290	340	510	570	120	130	
21	24	2000	260	300	290	340	480	540	120	130	
24	27	2000	260	300	290	340	450	500	120	130	
27	30	2000	260	300	290	340	450	500	120	130	
30	33	2000	260	300	290	340	520	580	120	130	
33	38	2000	260	300	290	340	680	750	120	130	
38	43	2000	260	300	290	340	800	880	120	130	
43	50	2000	260	300	290	340	800	880	120	130	

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**18. Optical Characteristics of WF tuning & verification modules**

1. Measure 5 modules\* per FPL batch by MPX at 25°C. Measurement data need to follow separate Spec.
2. Waveform used is GC16 full.

@25°C

Parameter	Min	Max	Units	Comment
Linearity	0.8	1.2	Y	
Linearity Delta	0.9	-	L*	Difference between adjacent grey levels.

Remark:

- \* 5 modules are included
- 3 waveform tuning modules in EIC
  - 2 waveform verification modules in EIH